THE INSECT PEST SURVEY BULLETIN

Volume 17 Supplement to Number 9 December 15, 1937

BUREAU OF
ENTOMOLOGY AND PLANT QUARANTINE
UNITED STATES
DEPARTMENT OF AGRICULTURE
AND
THE STATE ENTOMOLOGICAL
AGENCIES COOPERATING

I N S E C T P E S T S U R V E Y B U L L E T I N

Vol. 17 Supplement to No. 9 December 15, 1937

LIBERATIONS OF JAPANESE BEETLE PARASITES IN THE EASTERN STATES IN 1937

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This report includes in tabular form the present and former liberations of three of the major species and one racial form of the parasites of the Japanese beetle as distributed in nine States. The arrangement of the tables shows the distribution of parasite colonies in the States and counties, also the annual progress in these areas. Grand totals are given for combined States. Where parasite colonies are 3 years old (liberated in 1934) or older their recovery status is also indicated.

Although five species and one racial form are known to be established, two species, namely, Dexia ventralis Ald. and Prosena siberita F., are not included in this report because neither has been actively colonized since 1934 or earlier. Both these species are feebly established in New Jersey but, because of limitations in their ability to become established, further active distribution of the species has been held in abeyance until more favorable conditions for their colonization may be found.

Tiphia vernalis Roh.--From 1926 to 1937, 811 colonies of this parasite were liberated in the field, 161 of these being liberated in 1937. For the most part, these colonies have consisted of units of 100 mated females at each releasement, the exceptions being the early colonies of imported material, which were much larger, ranging from 300 to 500 females per colony. The catch of 16,100 females of T. vernalis in 1937 is the largest collection since the work began, as is shown in table 1, and in the diagram illustrating the annual colonization of this species.

Scouting for recovery or establishment has followed releasement 3 years after the date of initial liberation. In the case of T. vernalis, out of a total of 351 liberations made during the years 1926 to 1934,

1/ The writer acknowledges the assistance of his associates, T. R. Gardner, L. B. Parker, M. H. Brunson, and I. M. Hawley, who were actively engaged in the work of colony distribution and recovery scouting.

inclusive, 223 colonies have been recovered. Therefore we are certain that at least 63.5 percent of the colonies became established. It is believed that if more time could be spent in scouting, a higher percentage of recovery would be indicated.

Studies conducted in 1937 at the Overbrook Country Club in Pennsylvania of the parasitization caused by T. vernalis show that in diggings of 565 square feet over the entire golf course the host-grub population averaged 0.87 grub per square foot and that the average parasitization for this area was 36.4 percent. In one limited area of 40 square feet where the host averaged 1.33 grubs per square foot, parasitization ran as high as 66 percent.

Tiphia popilliavora Roh.--The total number of colonies for this species is 583 (see table 2). Most of these date from 1927, having been collected from early established colonies (see diagram of annual colony distribution). Unfortunately, the collection of adults for distribution in 1936 dropped to 4,400 females and in 1937 to 2,600, thus permitting the distribution of only 44 colonies in 1936 and 26 in 1937. This drop in abundance is attributed to a marked decline in host population in the older area infested by the Japanese beetle. It is expected, however, that collection may be augmented in the future by drawing from colonies in the outer areas where the host is more abundant.

Scouting to determine the percentage of colony establishment for this species of all colonies 3 years old or older shows that of 378 colonies under consideration, 191, or 50.5 percent, were recovered. As in the case of T. vernalis, more time spent in scouting would doubtless increase the percentage of establishment.

Surveys to determine the effectiveness of this species have not been satisfactory because they have been too limited in area. It has been impossible to locate suitable areas for survey where the resulting turf injury is not objectionable to the owner. In 1935, in digging 91 square feet at the Llanerch Country Club in Pennsylvania, host larvae were found to be abundant, yet only 3.9 percent were parasitized; however, this percentage did not seem commensurable with the abundance of parasites in the field. It is generally conceded that parasitization is "spotty" and if surveys are not extensive enough to include some of the areas of heavy parasitization, no adequate idea of the effectiveness of the species can be gained.

Tiphia popilliavora Roh. (Korean strain).--This racial form of the Japanese type is from Chosen (Korea). It has been more recently introduced and has been colonized in 30 different locations in 4 States (see table 3). This strain or race is seasonally later, occurring from 2 to 3 weeks after the type; therefore it has been reasoned that it should be more properly synchronized with the appearance of third-stage host larvae, and, therefore, should be more useful than the type strain in certain areas south of the major area infested by the Japanese beetle. Most of the colonies of this parasite are so recent in origin that extensive scouting has not yet been conducted.

Centeter cinerea Ald.--This is the only dipterous parasite of the Japanese beetle which has become established over a wide area. It is a parasite of the adult beetle. A total of 22 colonies of this parasite were liberated from 1922 to 1937, inclusive (see table 4). A number of these colony centers in New Jersey and Pennsylvania have coalesced so that the fly is now found over a continuous area of 500 square miles. Not all of the initial liberations of this species have become established, as checks from time to time indicate that only 59 percent of the colonies have taken hold, while others have died out.

The species has been liberated in four States. The colonies in Connecticut and New Hampshire are somewhat experimental in nature to determine whether the parasite will be of more value there than it is in New Jersey and Pennsylvania. In the last-named States Centeter is not synchronized with its host, as it constantly appears before beetles become abundant. Thus in June parasitization of the host may reach 27.5 percent on the 25th, gradually declining to 5 percent on the 30th and dropping to 2.2 percent on July 6. After that it soon disappears.

Table 1.--Liberations and recoveries of Tiphia vernalis Roh., a Japanese beetle parasite

State and county	Colonies released in --												Recovery of colonies 3 years old or older		Recovery of colonies scouted	Total 1926-37
	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	Number scouted	Status 1937		
Connecticut:															Percent	
Fairfield	--	--	--	--	--	--	--	--	--	--	3	2	--	--	--	5
New Haven	--	--	--	--	--	--	--	--	--	--	1	2	--	--	--	3
New London	--	--	--	--	--	--	--	--	--	--	--	1	--	--	--	1
Total	--	--	--	--	--	--	--	--	--	--	4	5	--	--	--	9
Delaware:																
New Castle	--	--	--	--	--	--	--	--	5	6	22	5	5	5	--	38
Kent	--	--	--	--	--	--	--	--	--	--	4	--	--	--	--	4
Total									5	6	26	5	5	5	100	42
District of Columbia: (Washington)	--	--	--	--	--	--	--	--	1	--	--	--	1	0	--	1
Total	--	--	--	--	--	--	--	--	1	--	--	--	1	0	0	1
Maryland:																
Baltimore City	--	--	--	--	--	--	--	--	1	--	3	-	1	1	--	4
Cecil	--	--	--	--	--	--	--	--	1	--	3	24	1	1	--	28
Dorchester	--	--	--	--	--	--	--	--	--	--	1	--	--	--	--	1
Frederick	--	--	--	--	--	--	--	--	--	--	1	--	--	--	--	1
Washington	--	--	--	--	--	--	--	--	--	--	1	--	--	--	--	1
Total	--	--	--	--	--	--	--	--	2	--	9	24	2	2	100	35
Massachusetts:																
Hampden	--	--	--	--	--	--	1	1	--	--	--	1	2	1	--	3
Total	--	--	--	--	--	--	1	1	--	--	--	1	2	1	50	3

Table 1.--Liberations and recoveries of Tiphia vernalis Roh., a Japanese beetle parasite.--(Continued)

State and county	Colonies released in --												Recovery of colonies 3 years old or older		Recovery of colonies scouted	Total 1926-37
	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	Number scouted	Status 1937		
New Hampshire:															Percent	
Cheshire	--	--	--	--	--	--	--	--	--	--	--	1	--	--	--	1
Merrimac	--	--	--	--	--	--	--	--	--	--	1	--	--	--	--	1
Strafford	--	--	--	--	--	--	--	--	--	--	1	--	--	--	--	1
Total	--	--	--	--	--	--	--	--	--	--	2	1	--	--	--	3
New Jersey:																
Atlantic	--	--	--	--	--	--	--	--	--	1	2	--	--	--	--	3
Burlington	1	--	2	1	1	--	--	9	9	4	--	--	23	12	--	27
Camden	--	2	--	--	--	--	1	6	--	--	--	--	9	9	--	9
Cape May	--	--	--	--	--	--	--	--	--	--	2	--	--	--	--	2
Cumberland	--	--	--	--	--	--	--	--	5	--	1	--	5	4	--	6
Gloucester	--	--	--	--	--	--	4	6	--	3	--	--	10	6	--	13
Hunterdon	--	--	--	--	--	--	--	--	--	16	20	2	--	--	--	38
Mercer	--	--	--	--	--	--	5	24	17	6	--	--	46	23	--	52
Middlesex	--	--	--	--	--	--	--	1	1	7	5	9	2	2	--	23
Monmouth	--	--	--	--	--	--	--	2	10	6	--	--	12	7	--	18
Ocean	--	--	--	--	--	--	--	3	1	--	--	--	4	1	--	4
Salem	--	--	--	--	--	--	2	10	1	5	--	--	13	7	--	18
Somerset	--	--	--	--	--	--	--	1	5	12	29	11	6	4	--	58
Union	--	--	--	--	--	--	--	--	--	--	--	18	--	--	--	18
Total	1	2	2	1	1		12	62	49	60	59	40	130	75	57.6	289
New York:																
Nassau	--	1	--	--	--	--	--	--	--	--	--	--	--	--	--	1
Queens Borough	--	--	--	--	1	--	--	--	--	--	--	--	1	1	--	1
Staten Island	--	--	--	--	--	--	--	--	--	--	--	10	--	--	--	10
Total	--	1	--	--	1	--	--	--	--	--	--	10	1	1	100	12

Table 1.--Liberations and recoveries of Tiphia vernalis Roh., a Japanese beetle parasite-(Continued)

State and county	Colonies released in --												Recovery of colonies 3 years old or older		Recovery of colonies scouted	Total 1926-37
	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	Number scouted	Status 1937		
Pennsylvania:															Percent	
Berks	--	--	--	--	--	--	--	--	--	--	3	--	--	--	--	3
Bucks	--	--	--	3	--	9	8	15	18	26	25	24	53	29	--	128
Chester	--	--	--	--	--	--	2	2	13	36	22	22	17	12	--	97
Cumberland	--	--	--	--	--	--	--	--	1	--	--	--	1	1	--	1
Dauphin	--	--	--	--	--	--	--	--	1	--	--	1	1	1	--	2
Delaware	--	--	--	--	--	1	9	9	23	11	--	--	42	24	--	53
Lehigh	--	--	--	--	--	--	--	--	--	--	--	1	--	--	--	1
Monroe	--	--	--	--	--	--	--	--	--	--	--	2	--	--	--	2
Montgomery	--	1	1	2	4	1	19	13	40	1	6	25	81	59	--	113
Philadelphia	--	--	--	--	1	--	7	6	1	1	--	--	15	13	--	16
Total	--	1	1	5	5	11	45	45	97	75	56	75	210	139	66.2	416
Rhode Island:																
Providence	--	--	--	--	--	--	--	--	--	--	1	--	--	--	--	1
Total	--	--	--	--	--	--	--	--	--	--	1	--	--	--	--	1
Grand Total	1	4	3	6	7	11	58	108	154	141	157	161	351	223	63.5	811

Table 2.--Liberations and recoveries of Tiphia popilliavora Roh., a Japanese beetle parasite

State and county	Colonies released in --												Recovery of colonies 3 years old or older		Recovery of colonies scouted	Total 1921-37
	1921	1922	1925	1927	1928	1929	1930	1931	1934	1935	1936	1937	Number scouted	Status 1937		
															Percent	
Connecticut:																
Fairfield -----	--	--	--	--	--	--	--	--	--	--	--	4	--	--	--	4
New Haven -----	--	--	--	--	1	--	--	--	--	--	--	--	--	--	--	1
Hartford ------	--	--	--	--	--	--	--	--	--	--	--	2	--	--	--	2
Total ------	--	--	--	--	1	--	--	--	--	--	--	6	--	--	--	7
Delaware																
New Castle ----	--	--	--	--	--	--	--	--	4	5	14	8	4	2	--	31
Total ------	--	--	--	--	--	--	--	--	4	5	14	8	4	2	50	31
Maryland:																
Cecil ---------	--	--	--	--	--	--	--	--	1	3	--	7	1	0	--	11
Total ------	--	--	--	--	--	--	--	--	1	3	--	7	1	0	0	11
New Jersey:																
Burlington ----	2	1	1	4	12	24	--	13	5	5	--	--	62	31	--	67
Camden --------	--	--	--	2	2	1	1	2	--	1	--	--	8	4	--	9
Gloucester ----	--	--	--	1	--	14	--	1	--	7	--	--	16	2	--	23
Hunterdon -----	--	--	--	--	--	--	--	--	--	4	14	--	--	--	--	18
Mercer --------	--	--	--	--	1	1	--	4	37	5	1	--	43	16	--	49
Middlesex -----	--	--	--	--	--	--	--	--	3	2	--	--	3	0	--	5
Monmouth ------	--	--	--	--	--	--	--	--	--	1	--	--	--	--	--	1
Salem ---------	--	--	--	--	--	--	--	5	--	15	--	--	5	1	--	20
Somerset ------	--	--	--	--	--	--	--	--	3	24	2	2	3	2	--	31
Total ------	2	1	1	7	15	40	1	25	48	64	17	2	140	56	40	223

Table 2.--Liberations and recoveries of Tiphia popilliavora Roh., a Japanese beetle parasite--(Continued)

State and county	Colonies released in --												Recovery of colonies 3 years old or older		Recovery of colonies scouted	Total 1921-37
	1921	1922	1925	1927	1928	1929	1930	1931	1934	1935	1936	1937	Number scouted	Status 1937	Percent	
New York:																
Nassau	--	--	--	1	1	--	--	--	--	--	--	--	2	0	--	2
Queens Borough-	--	--	--	--	1	--	--	--	--	--	--	--	1	0	--	1
Total	--	--	--	1	2	--	--	--	--	--	--	--	3	0	0	3
Pennsylvania:																
Bucks	--	--	--	1	4	22	--	5	31	41	8	--	63	23	--	112
Chester	--	--	--	--	--	--	1	--	15	5	4	3	16	9	--	28
Cumberland	--	--	--	--	--	--	--	--	1	--	--	--	1	0	--	1
Dauphin	--	--	--	--	--	1	--	--	1	--	--	--	2	0	--	2
Delaware	--	--	--	--	4	10	--	--	38	--	--	--	52	32	--	52
Montgomery	--	--	--	--	7	19	--	13	46	15	--	--	85	55	--	100
Philadelphia	--	--	--	2	--	9	--	--	--	1	1	--	11	9	--	13
Total	--	--	--	3	15	61	1	18	132	62	13	3	230	133	57.8	308
Grand total	2	1	1	11	33	101	2	43	135	134	44	26	378	191	50.5	583

Table 3.-- Liberations and recoveries of Tiphia popilliavora Roh. (Korean strain), a Japanese beetle parasite--

State and County	Colonies released in 1927	1934	1935	1936	1937	Colonies recovered	Total 1927-37
Delaware:							
New Castle	--	--	--	--	3	0	3
Total	--	--	--	--	3	0	3
Maryland:							
Cecil	--	--	--	--	1	0	1
Total	--	--	--	--	1	0	1
New Jersey:							
Camden	1	1	--	--	--	1	2
Hunterdon	--	--	4	--	--	0	4
Mercer	--	--	1	--	--	1	1
Middlesex	--	--	--	1	--	0	1
Somerset	--	--	--	2	3	0	5
Total	1	1	5	3	3	1	13
Pennsylvania:							
Montgomery	--	--	3	--	--	0	3
Philadelphia	--	--	1	--	--	0	1
Delaware	--	1	--	--	--	1	1
Chester	--	--	--	6	2	0	8
Total	--	1	4	6	2	1	13
Grand total	1	2	9	9	9	*3	30

*Extensive scouting for recovery of this species has not been started.

Table 4.--Liberations and recoveries of Centeter cinerea Ald.,

a parasite of the Japanese beetle

State and county	Colonies released in --								Colonies recovered	Total 1922-37
	1922	1924	1928	1929	1934	1935	1936	1937		
Connecticut:										
Fairfield	--	--	1	1	--	--	--	--	1	2
Hartford	--	--	--	--	--	--	--	1	--	1
Total	--	--	1	1	—	--	--	1	1	3
New Jersey:										
Burlington	--	--	--	2	--	--	--	--	1	2
Camden	1	--	--	--	--	--	--	--	1	1
Hunterdon	--	--	--	--	1	--	--	--	1	1
Middlesex	--	--	--	--	1	--	--	--	1	1
Total	1	--	--	2	2	--	--	--	4	5
Pennsylvania:										
Berks	--	--	--	--	--	1	--	--	1	1
Bucks	--	1	--	1	1	--	--	--	2	3
Dauphin	--	--	1	3	--	--	--	--	1	4
Delaware	--	--	--	1	--	--	--	--	0	1
Montgomery	--	--	1	1	1	--	--	--	3	3
York	--	--	--	1	--	--	--	--	0	1
Total	--	1	2	7	2	1	--	--	7	13
New Hampshire:										
Cheshire	--	--	--	--	--	--	1	--	1	1
Total	--	--	--	--	--	--	1	--	1	1
Grand total	1	1	3	10	4	1	1	1	13(59%)	22

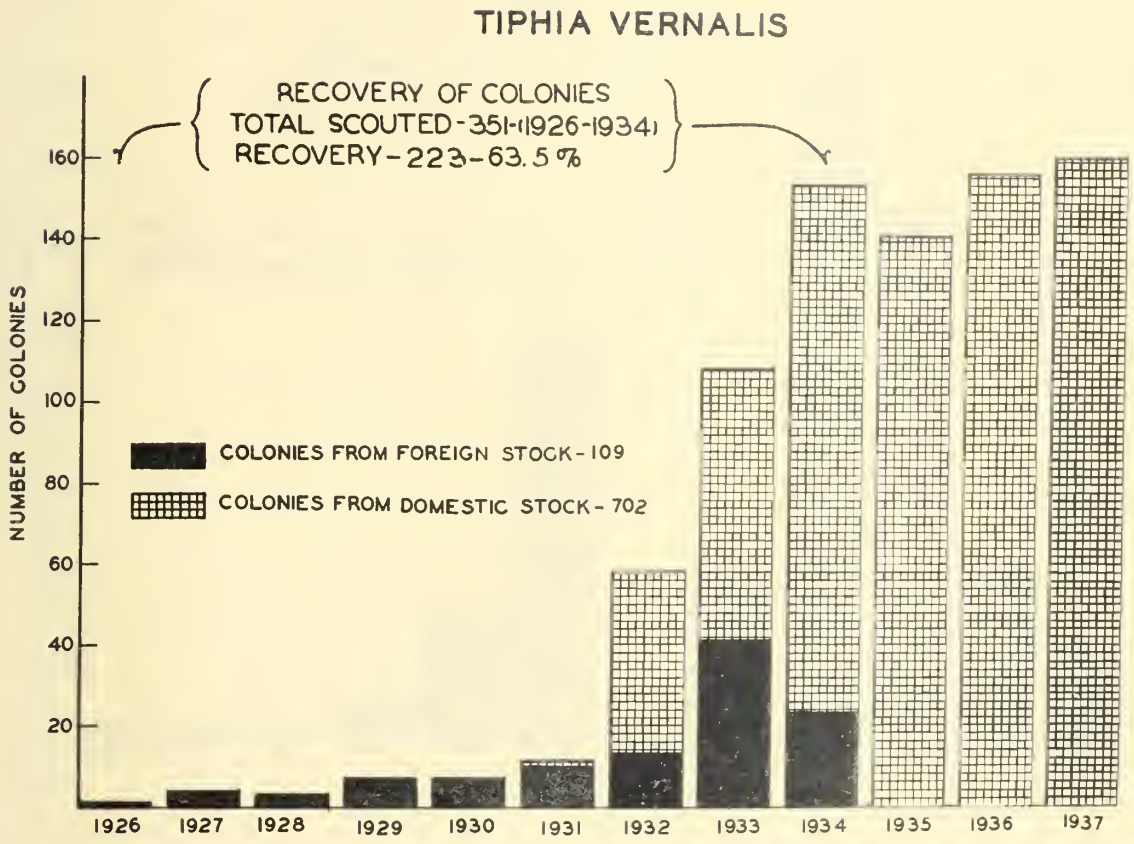


Diagram of the annual colonization of Tiphia vernalis Roh. Each colony consists of 100 or more female Tiphia.

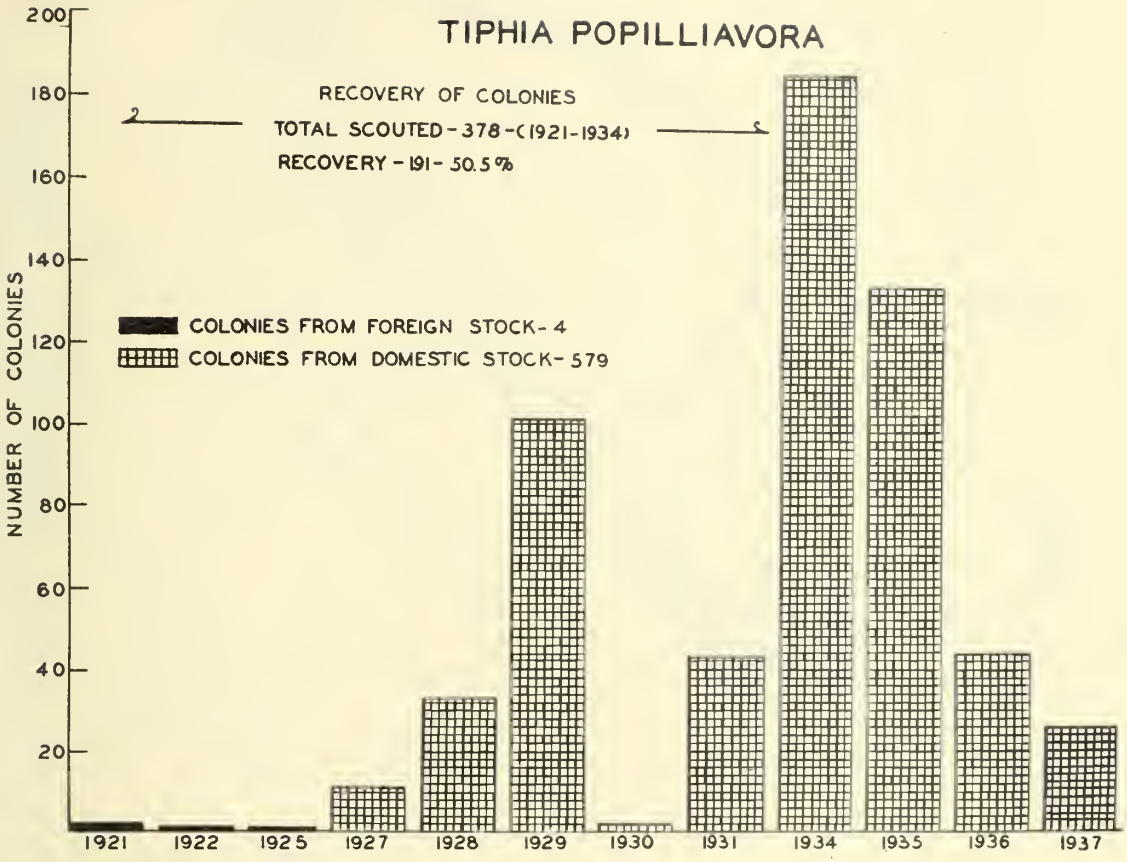
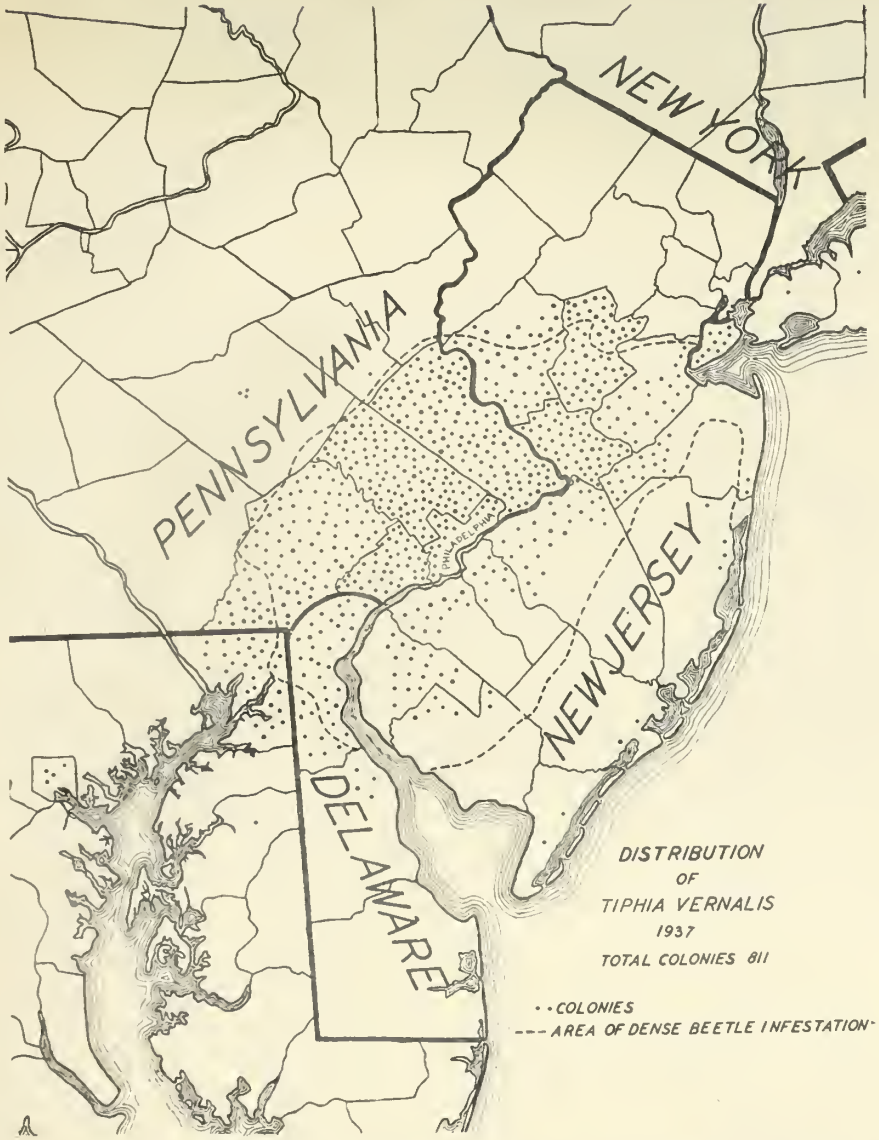
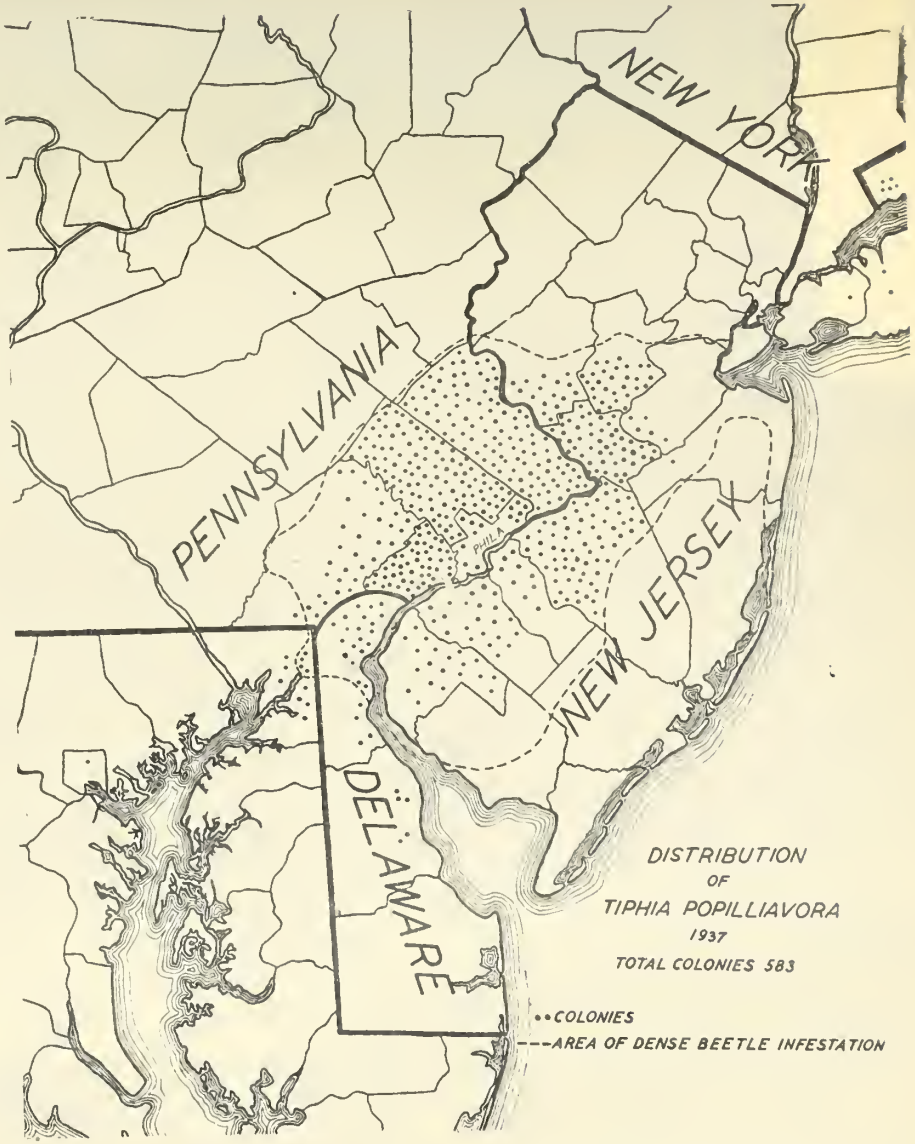


Diagram of the annual colonization of Tiphia popilliavora Roh. Each colony consists of 100 or more female Tiphia.





Maps showing in general the distribution of the colonies of Tiphia vernalis and Tiphia popilliavora.